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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  Naval Air Systems Command Department of the Navy 1421 Jefferson Davis Highway Arlington, VA 22243		10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION/AVAILABILITY STATEMENT  Approved for public release, distribution is unlimited.		12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)  <i>This presentation shows the facilities available at the Naval Electromagnetic Radiation Facility. Some areas include: Test areas, Continuous Steel Ground Plane, Aircraft Anechoic Test Facility, the hangar, Test Vans, Telemetry Van Layout, Radar Transmitters, Amplifiers, Modulation Sources, etc.</i>			

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*E ncl (3)*



CLEARANCE

5 APR 1996

*James A. Green*

**Naval**

# ***Electromagnetic Radiation Facility Capabilities Description***

Naval Electromagnetic Radiation Facility

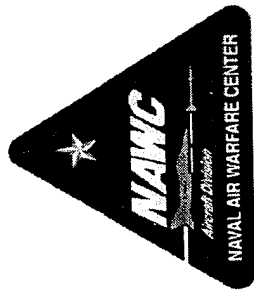
January 2, 1996



# ***Naval Electromagnetic Radiation Facility Capabilities Description***

Naval Electromagnetic Radiation Facility

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# Facilities

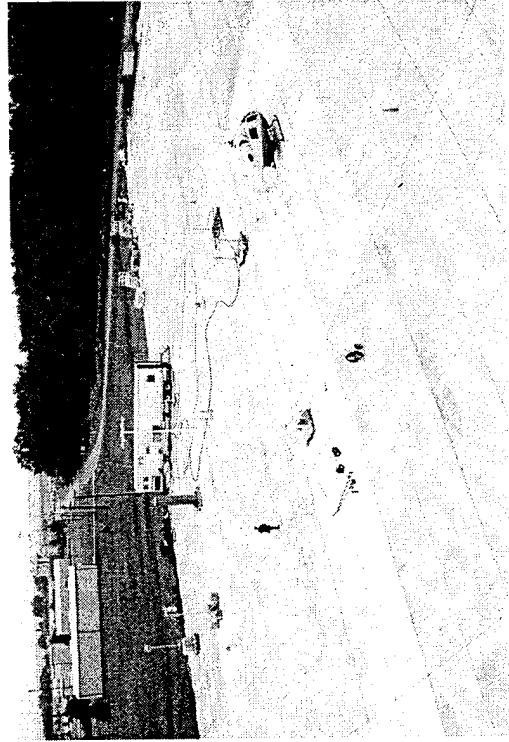
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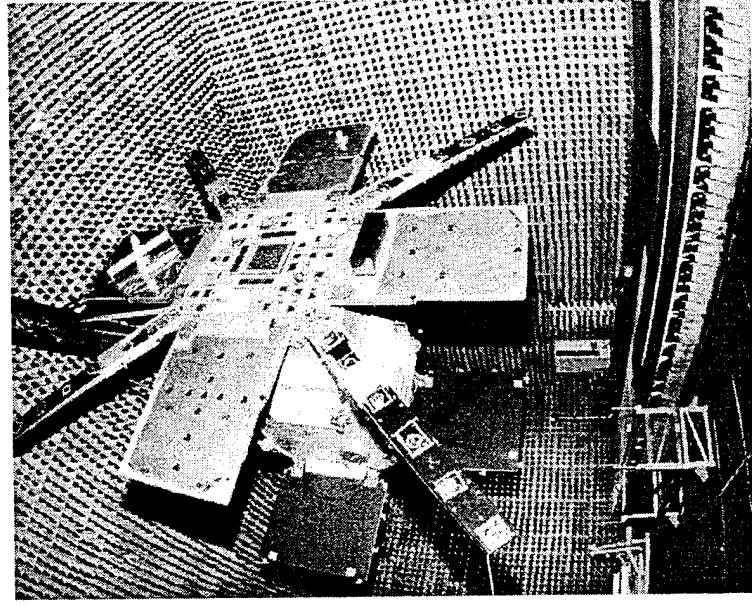
- ☐ Test Areas
- ☐ Test Vans
- ☐ Transmitter Equipment
- ☐ E-Field Calibration Equipment



# Test Areas



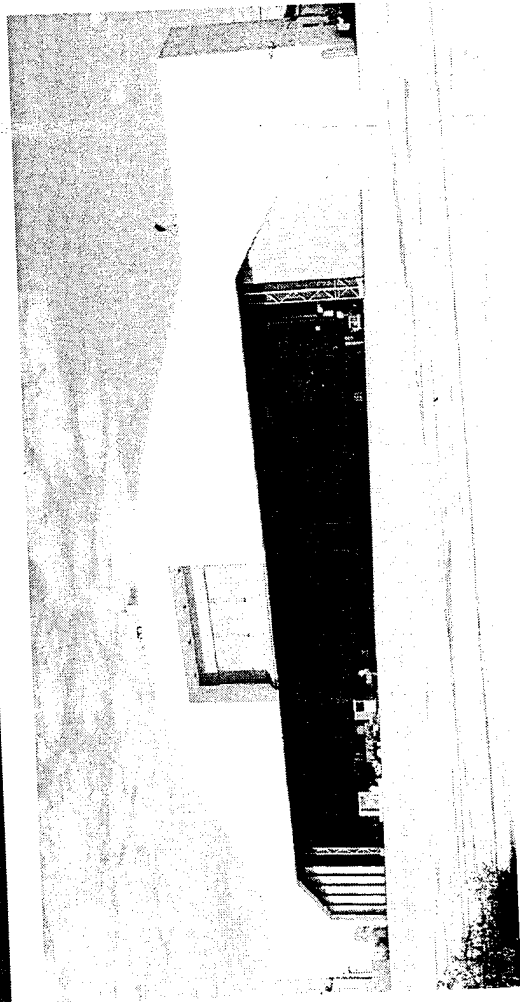
□ Hangar Apron (embedded ground plane)



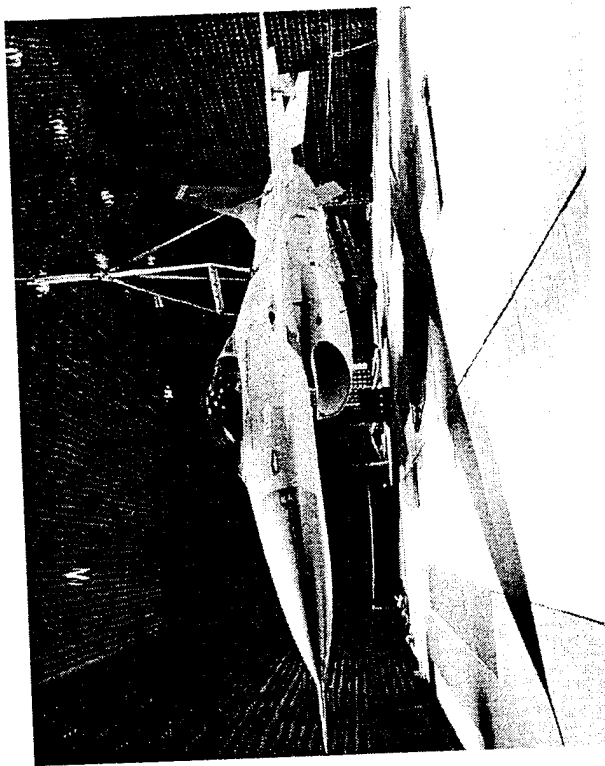
□ AATF



# Test Areas



□ Inside Hangar

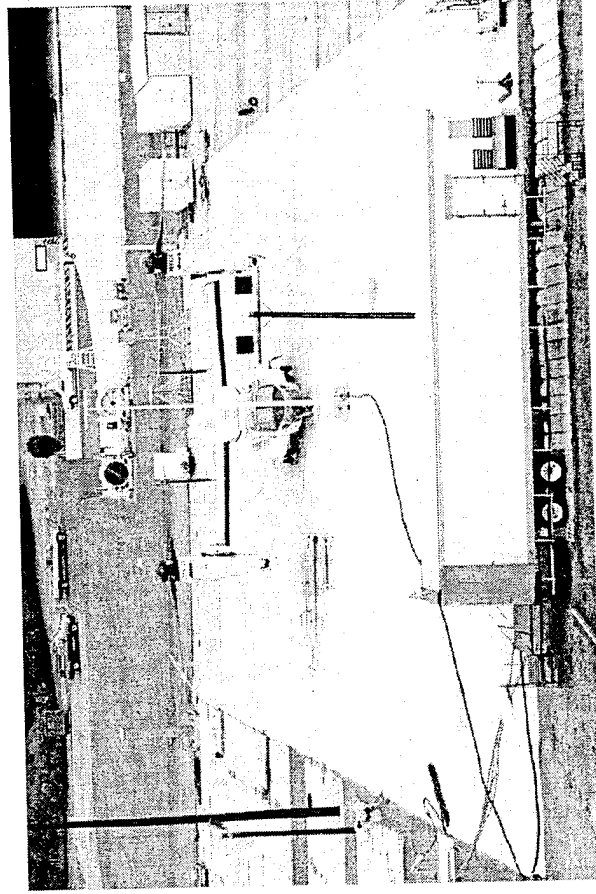


□ Inside AATF



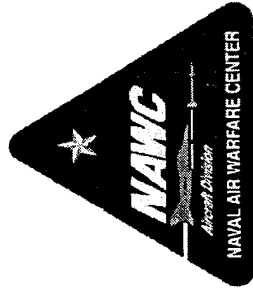
# *Continuous Steel Ground Plane*

- ❑ 100' Wide x 240' Long Steel Ground Plane with a modified set of Alameda Chocks with blast deflector
  - ❑ Electric Service
    - 480VAC, 60 Hz, 3-Phase Delta, 400 Amps (8 100 AMP Receptacles)
    - 120/208 VAC, 60 Hz, 3-Phase Wye 100 KVA Service
    - 115VAC, 400 Hz, 3-Phase Delta, 200 KVA Service (Standard DOD Aircraft Plugs)



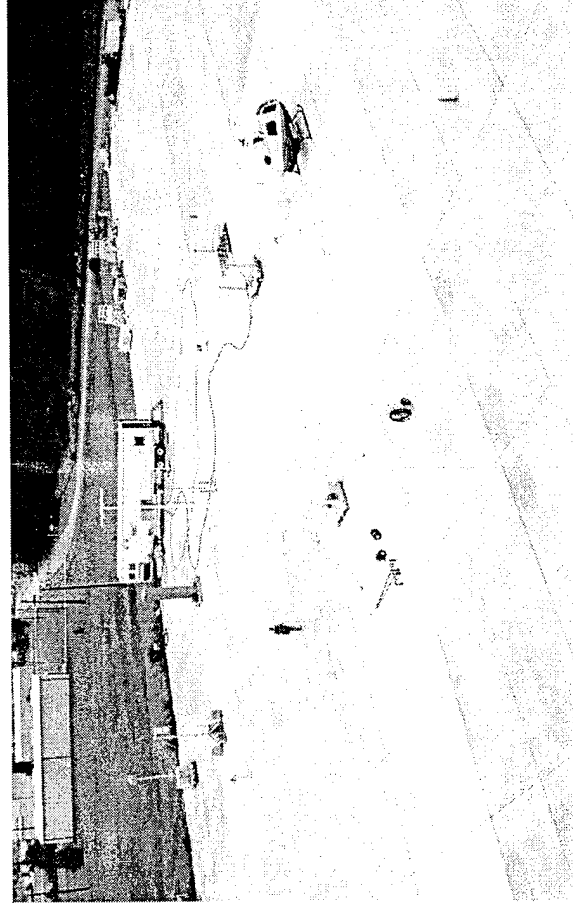
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# Hangar Apron

- ❑ 300' wide x 600' long Apron in front of the Shielded Hangar
  - ❑ Embedded 200' wide x 400' long, wire grid (10' x 10') ground plane under the concrete
  - ❑ Electric Service
    - 480VAC, 60 Hz, 3-Phase Delta, 400 Amps (5 100 AMP Receptacles)
  - ❑ Aircraft Turns Allowed





# AATF

## ☐ Aircraft Anechoic Test Facility (limited frequency coverage)

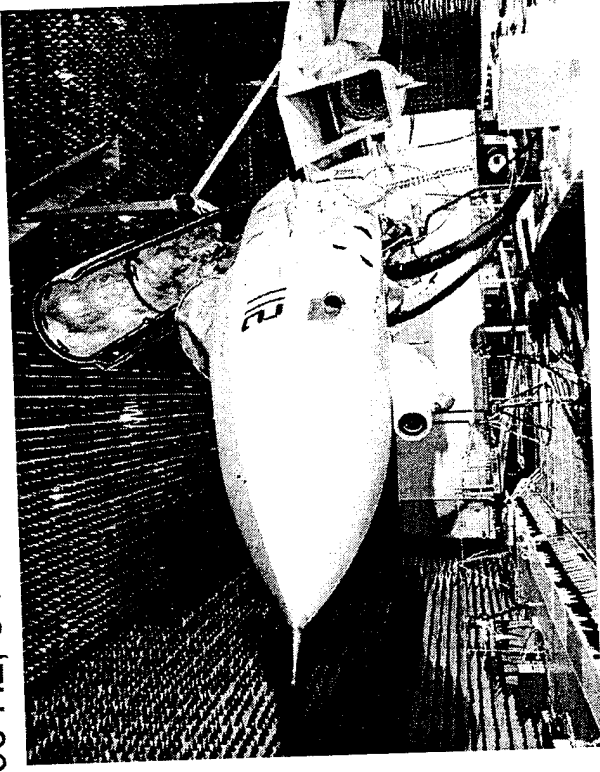
### ☐ Electric Service

480VAC, 60 Hz, 3-Phase Delta

120/208 VAC, 60 Hz, 3-Phase Wye 100 A Service

Standard DOD 28VDC Aircraft Power

115VAC, 400 Hz, 3-Phase Delta, 200 kVA Service (Standard DOD Aircraft Plugs)



Naval Electromagnetic Radiation Facility

January 2, 1996



# *Inside Hangar*

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## ☐ Inside the Shielded Hangar (limited frequency coverage)

### ☐ Electric Service

480VAC, 60 Hz, 3-Phase Delta, 400 Amp Service

120/208 VAC, 60 Hz, 3-Phase Wye 100 KVA Service

Standard DOD 28VDC Aircraft Power

115VAC, 400 Hz, 3-Phase Delta, 200 KVA Service (Standard  
DOD Aircraft Plugs)



# *Limited Frequency Coverage*

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- ☐ Frequencies and power levels are limited to those frequencies and power levels for which safety of personnel and equipment can be maintained and must be evaluated on a case by case basis. Generally, frequencies above 1 GHz are ok.



# Test Vans

☐ TV#1

☐ TV#2

☐ TV#3

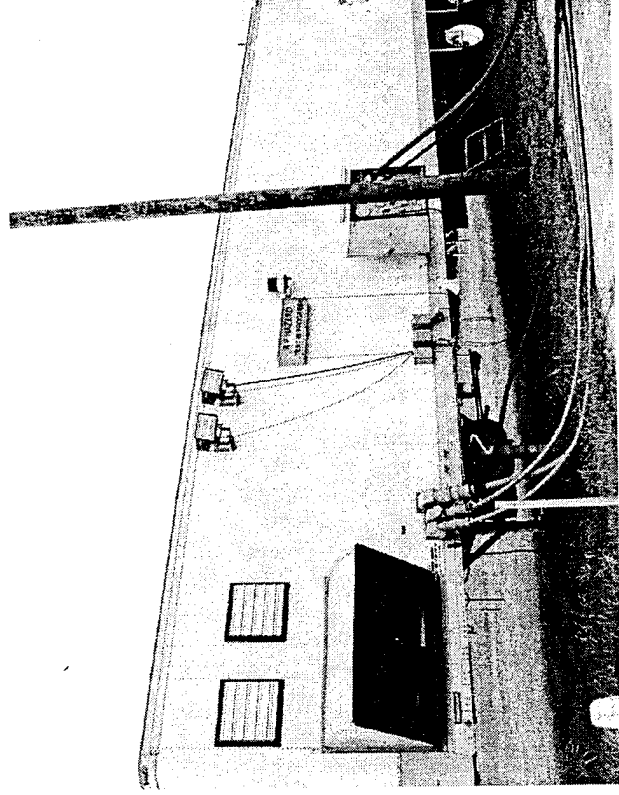
☐ TV#4

☐ Telemetry Van



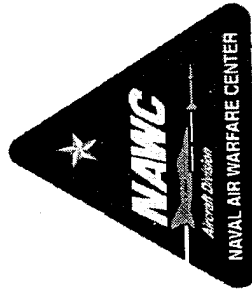
# TV#1

- ☐ Contains Class A High Power Amplifier Systems
- ☐ 45' Semitrailer
- ☐ Self Contained Heating and Cooling
- ☐ Two Separate, Completely Shielded Rooms
- ☐ 30' Waveguide Cart Attached to Side
- ☐ Requires 3 480VAC, 60 Hz, 3-phase, 100 Amp Standard GSE Power Receptacles



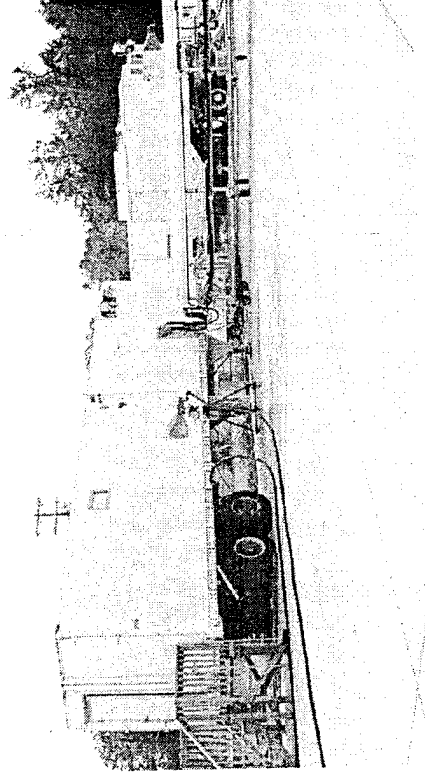
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## TV#2

- ☐ Contains the Cober 1-34 GHz Magnetron Transmitter
- ☐ 45' Semitrailer
- ☐ Self Contained Heating and Cooling
- ☐ 30' Waveguide Cart Attached to Side
- ☐ Requires 480VAC, 60 Hz, 3-phase, 100 Amp Standard GSE Power Receptacle



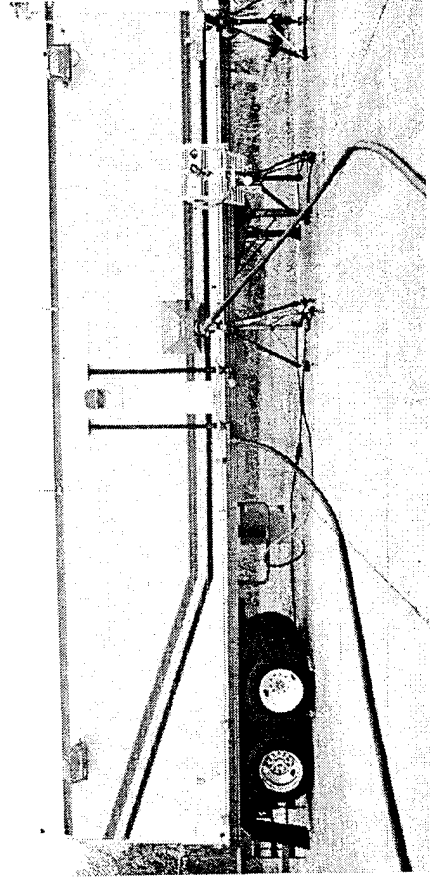
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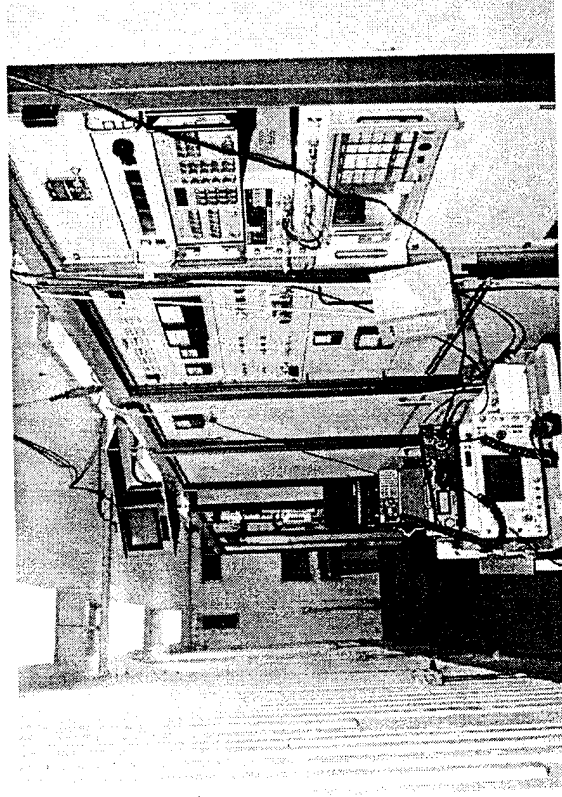


## TV#3

- ☐ Contains the B&C (400 & 900 MHz) Transmitters
- ☐ 45' Semitrailer
- ☐ Self Contained Heating and Cooling
- ☐ Requires 480VAC, 60 Hz, 3-phase, 100 Amp Standard GSE Power Receptacles



Naval Electromagnetic Radiation Facility

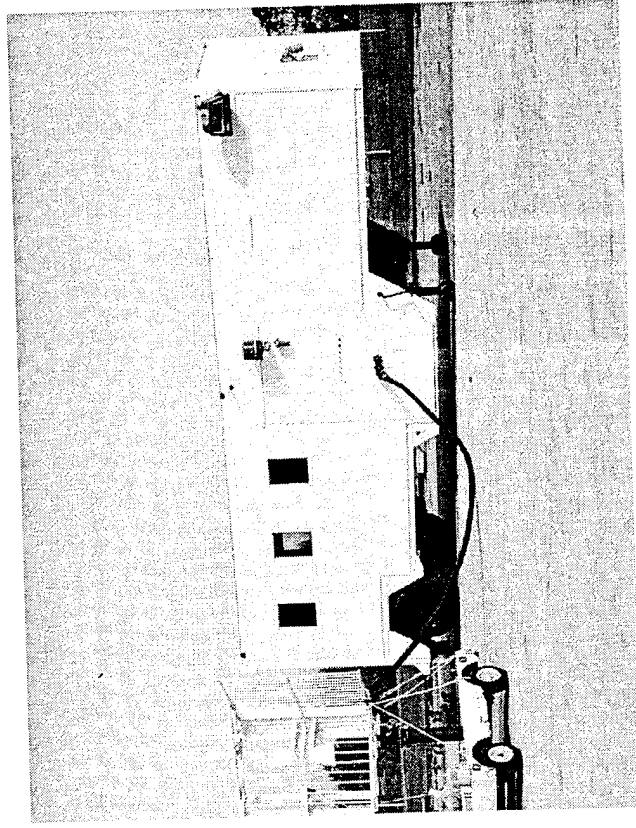


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## TV#4

- ☐ Contains the A Band (200 MHz) Transmitter
- ☐ 25' Lowboy Semitrailer
- ☐ Self Contained Heating and Cooling
- ☐ Requires 480VAC, 60 Hz, 3-phase, 100 Amp Standard GSE Power Receptacle (1 50 Amp min.)



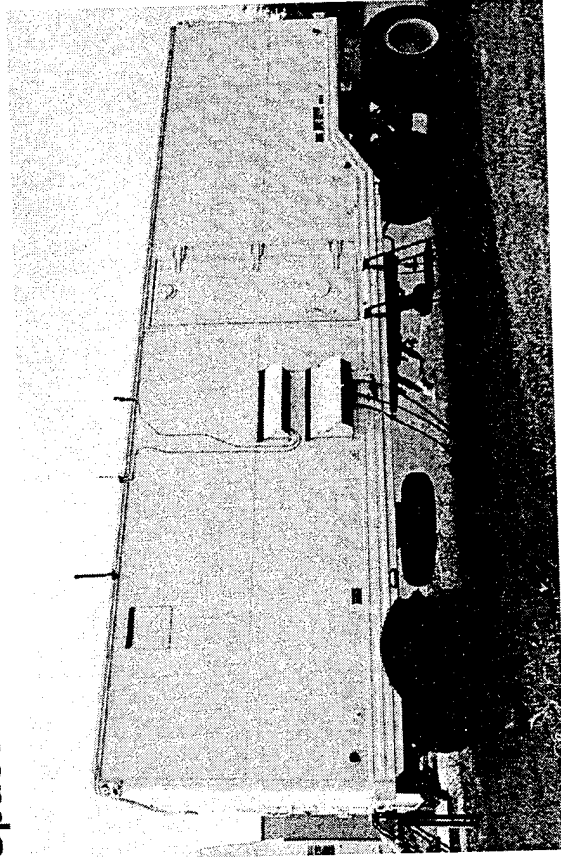
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# Telemetry Van

- ☐ 8' x 25' Shielded Military COMM Van
- ☐ Self Contained Heating and Cooling
- ☐ 120/208, 60 Hz Power Available
- ☐ Minimum 50' of Power Cord
- ☐ Requires 408VAC, 60 Hz, 3-phase Delta, 100 Amp GSE Receptacle
- ☐ Built In Work Benches and Open Floor Space
- ☐ Bulkhead Feedthrus, VHF Radio

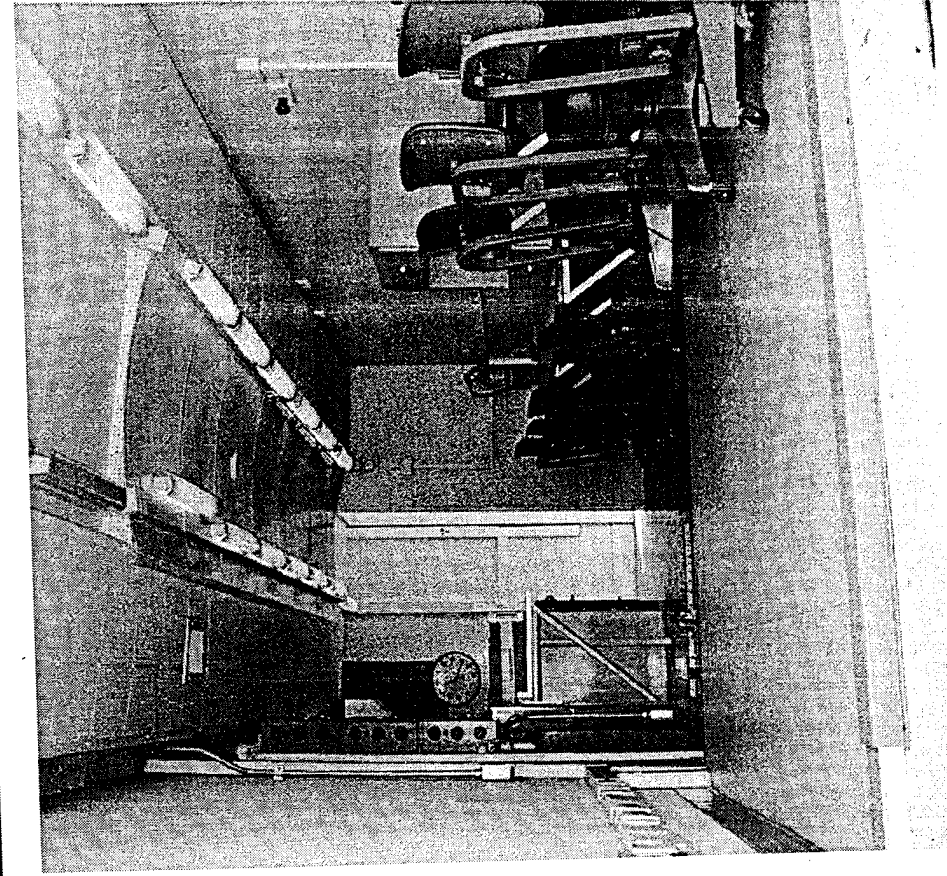


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# Telemetry Van Layout



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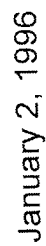


# ***Radar Transmitters***

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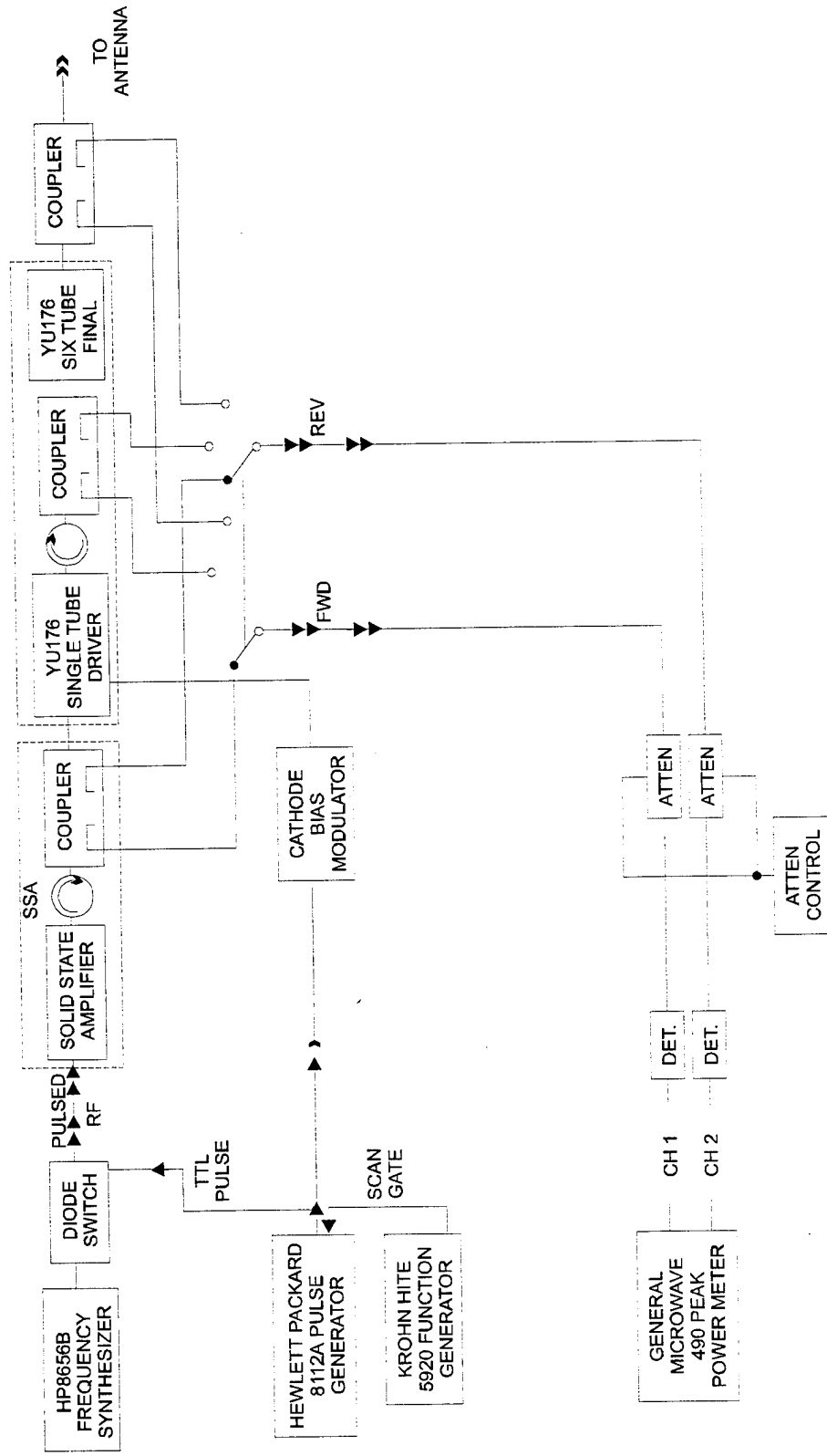
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- ☐ Discrete Frequency Tuned
- ☐ Magnetron and Tetrode Tube Based
- ☐ Antenna Scan Parameter Simulations
- ☐ No EW Modulation Capabilities



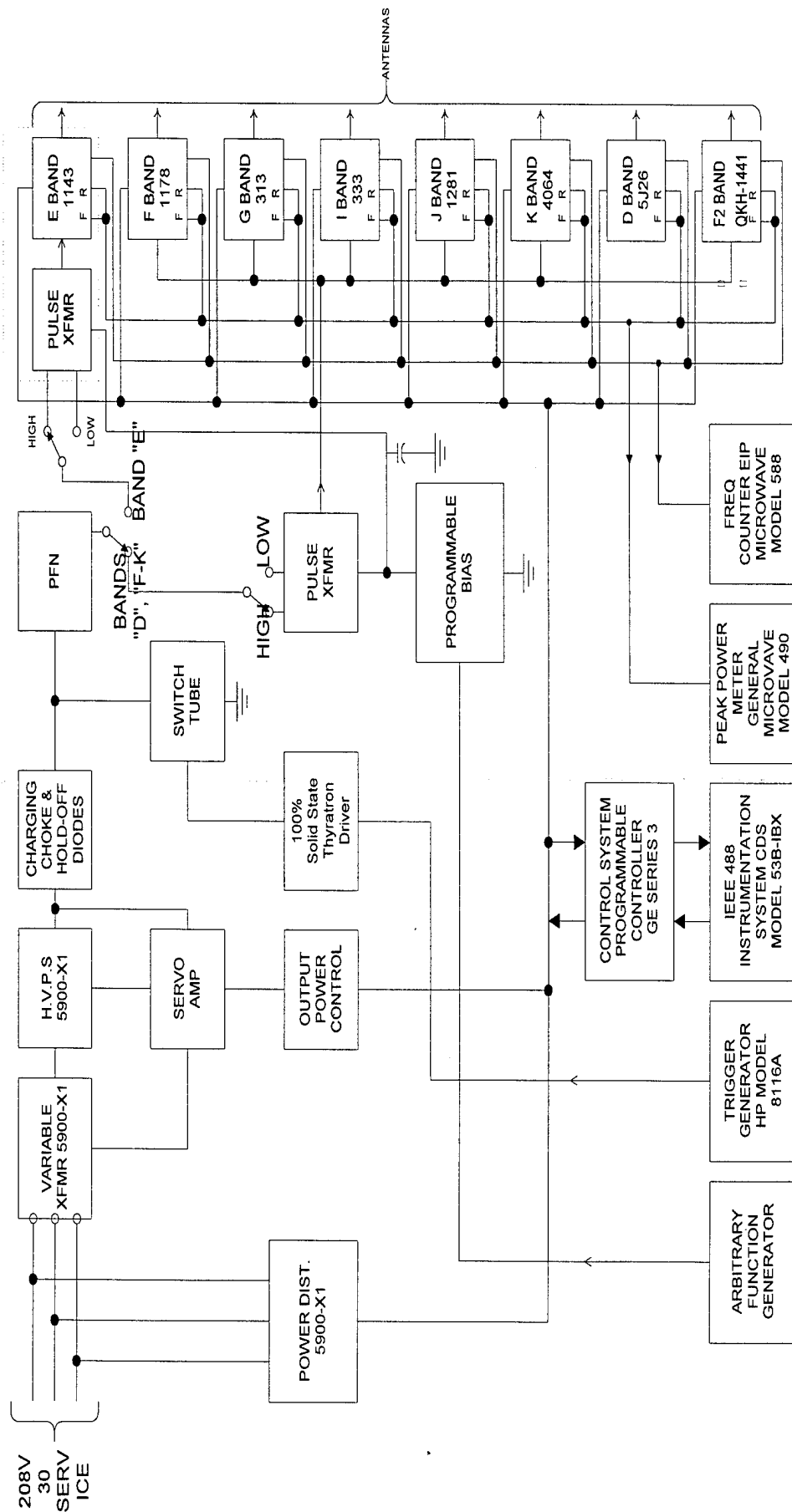


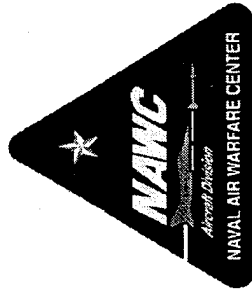
# C Band Block Diagram





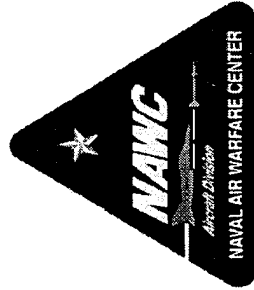
# Cober Block Diagram





# Radar Transmitter Parameters

Transmitter	Band	Freq Range (GHz)	PW (uS)	PRF (Hz)	Max Duty Cycle	Max Peak Power (KW)
H-6 A	A	.2-.24	1-200	<1000	.01 .007	225 325
H-6 B	B	.39-.48	1-200	<1000	.01 .007	225 325
H-6 C	C	.870-.940	1-50	<1000	.01	100
Cober	D	1.22-1.35	1,1.5,2,3,4	<1000	.001	400
	E	2.88+.03	.5,1.5,2	<1600	.0008	2850
	F	3.1-3.65	1,1.5	<1466	.002	1000
	G	5.4-5.9	.5,1,1.5,2	<2000	.001	1000
	I	14-15.2	1,1.5,2	<2000	.001	100
	J	35	.5,1	<2000	.001	125



# Radar Transmit Antennas

Band	Antenna Make	Part Number	Freq. (MHz)	Gain (dBi)	3 dB BW E/H Plane	2M Illum. Area (ft <sup>2</sup> )	E Plane Width (M)	H Plane Width (M)
A	Chu Corner Reflector	CA-3524	195	12.8	56.5/37	30	2.1	1.33
			220	11.1	50/38.5	19.8	1.3	1.39
			245	12.9	44/35.5	20.6	1.6	1.28
B	Chu Corner Reflector	CA-3525	385	11.5	53.5/45	35.5	2	1.65
			435	11.8	55.5/40.5	33.2	2.1	1.47
			485	12.8	48.35.5	24.5	1.78	1.28
C	Seavey Engr Assoc Horn	SGA-07	850	15.1	27/30	10.3	.96	1
			900	15.5	27/30			
			910	15.6	27/30			
			940	15.8	27/30			
D	Scientific Atlanta Horn	12-1.1	1250	15.2	30/27	10.3	1	.96
			1300	15.5	30/27			
			1350	15.7	30/27			
E	Seavey Engr Assoc Horn	HPH-27	2700	16.7	30/27	10.3	1	.96
			2800	17	24/22	7.0	.85	.77
			2900	17.3	23/27	8.3	.81	.96
F	Scientific Atlanta Horn	12-2.60	3100	18.2	23/22	6.7	.81	.77
			3600	19.15	23/22			
G	Scientific Atlanta Horn	12-3.9	5650	19.38	23/22	6.7	.81	.77
I	Syston Donner Horn	HPH-520	9200	20.05	16/14	3	.56	.49
			9400	20.22	16/14			
J	Scientific Atlanta Horn	12-12	14 GHz	24.15	9/10	1.1	.31	.34
K	Scientific Atlanta Horn	12A-26	35 GHz	24.7	9/10	1.1	.31	.34
K	4' Dish	SPN-42	35 GHz	48	0.5/0.5	1 @ 80'	.3	.3



# ***Radar Transmitters Maximum Peak Power Densities at the Near Field Boundary***

BAND	DISTANCE (M)	PEAK POWER DENSITY (MW/CM <sup>2</sup> )	PEAK FIELD INTENSITY (V/M)	DUTY
A	6.5	2,131	2,835	.007
B	3.5	1,188	2,116	.01
C	3.8	1,243	2,165	.01
D	2.7	11,319	6,533	.002
E	2.0	73,562	16,653	.0008
F	2.5	30,200	10,669	.001
G	1.8	100,410	19,456	.001
I	1.0	106,554	20,043	.001
J	2.1	2,238	2,905	.001
K	23.0	2,500	3,070	.001



# ***Class A High Power Amplifier Systems***

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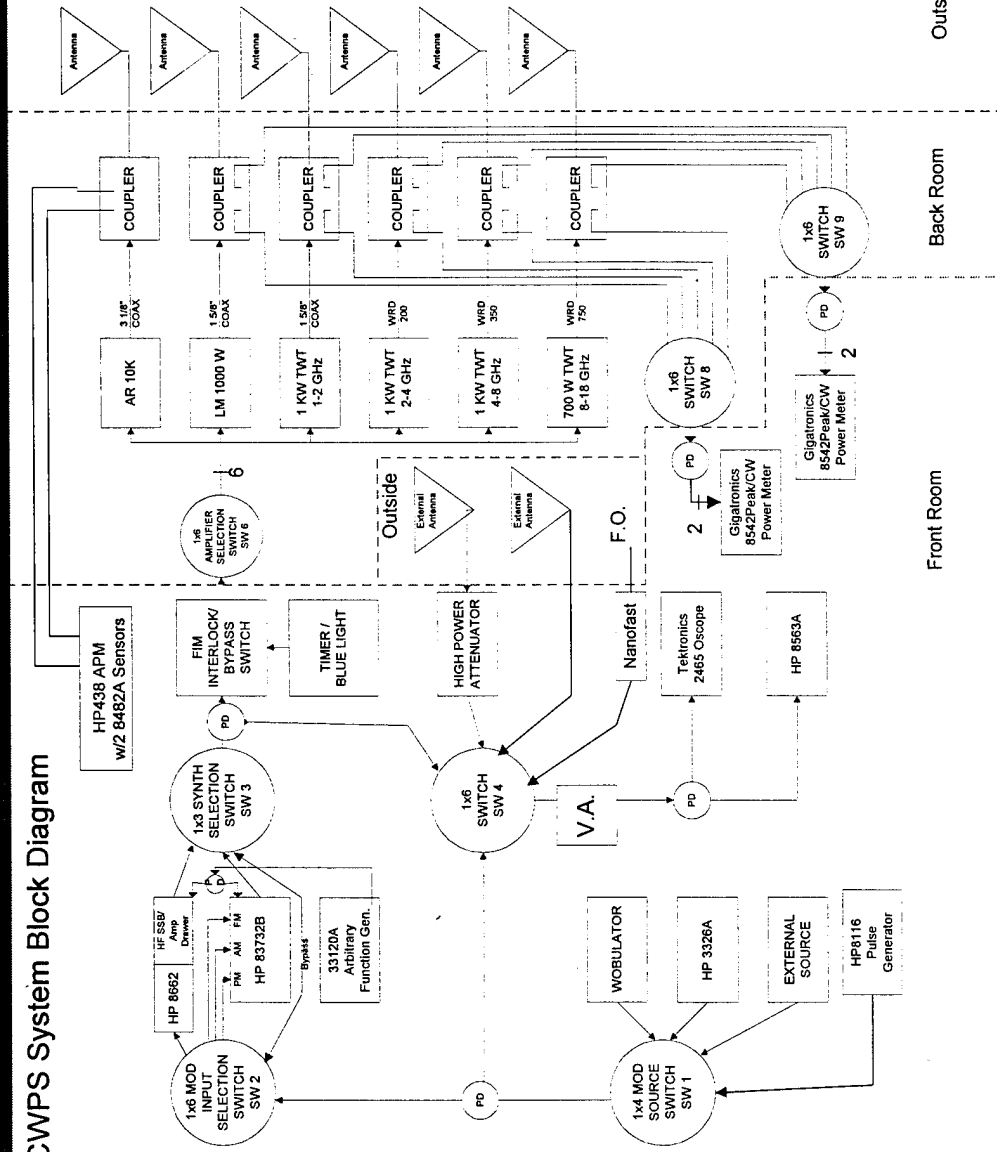
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- ☐ Block Diagram
- ☐ Class A Amplifiers
- ☐ Synthesized Signal Generators
- ☐ Modulation Sources
- ☐ Summary Capabilities & Antennas
- ☐ E-Field Calibration Equipment
- ☐ Typical Maximum E-Field Levels



# Class A High Power Amplifier System Block Diagram

CWPS System Block Diagram





# Class A Amplifiers

Freq Range	Model Number	Min CW Power Output	Gain Flatness	Harmonic Levels
10 KHz - 100 MHz	AR 10,000L	10 KW	$\pm 1.5$ dB	<20dB
100 MHz - 1000 MHz	AR LM1000W	1 KW	$\pm 2$ dB	<20dB
1 GHz - 2 GHz	Logimetrics A682/L	1 KW	$\pm 1.5$ dB	<20dB
2 GHz - 4 GHz	Logimetrics A682/S	1 KW	$\pm 1.5$ dB	<50dB
4 GHz - 8 GHz	Logimetrics A682/C	1 KW	$\pm 1.5$ dB	<50dB
8 GHz - 18 GHz	Logimetrics A682/IJ	800 Watts	$\pm 1.5$ dB	<50dB



# CWPS Synthesized Signal Generators

Freq Range	Model Number	Internal Modulation	External Modulation	Modulation Modes
10 KHz - 1.28 GHz	HP8662	AM:0-95% Depth 400 Hz or 1 KHz Rate FM:400 Hz or 1 KHz Rate Deviation: ,100 KHz; very Frequency Dependent	AM:0-95% Depth DC- 10 KHz(freq dependent) Rate FM:DC - 100 KHz Rate Deviation: ,100 KHz; Very Frequency Dependent	AM FM AM/FM
10 MHz - 20 GHz	HP 83732B	Waveforms: Sine, Ramp, Square, Triangle, Uniform Noise, Guassian Noise AM: 0-99.9% Depth FM: 1KHz-1 MHz Rate <10MHz Peak Dev PM: 3Hz-3MHz PRF 25nS-419mS PW Scan: >60dB Depth Phase Modulation	Any Waveform compatible with band width considerations. AM:0-99.9% Depth DC - 100 KHz Rate FM:10 Hz - 5 MHz Rate <10 MHz Deviation PM: PRF: 5 Hz - 5 MHz PW: >50 nSec On/Off Ratio >80 dB	Linear/Log AM FM PM AM/PM Phase Scan Modulation Phase/FM AM/PM/FM/Phase



# ***Modulation Sources***

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## ☐ **Custom In House Developed Function Generators**

- ☐ **TV Signal Simulator**
  - Standard and CATV Channels
  - Test Patterns or Live action
  - Choice of Audio
- ☐ **Pulse Generator**
  - 1-99% Duty Cycle
  - 250nS Rise Time
  - 50nS Fall Time
- ☐ **Wobulator**
  - 300-6000Hz Sweep Generator
  - 0.3-33 Hz Sweep Rate



# Modulation Sources

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## ☐ HP3326A

☐ DC - 13 MHz

☐ Sine, Square, Pulse, DC Waveforms

☐ Modes

2 Phase

2 Tone

Pulse

Swept Frequency



# *Modulation Sources*

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## ☐ External Source

- ☐ Any source compatible with the HP8662 or the HP83732 signal generators.
- ☐ Any source that can drive a class A amplifier.



# Antenna Scan Simulation

- ☐ HP33120A Function/Arbitrary Waveform Generator

Standard Waveforms: Sine, Square, Triangle,  $\frac{\sin(X)}{X}$

Arb Waveforms: 8 to 16K Points, 12 Bit Resolution

- ☐ Purpose: Realistic Emitters  
Limit/Control Personnel RADHAZ Exposure



# Class A High Power Transmitters Summary Capabilities and Antennas

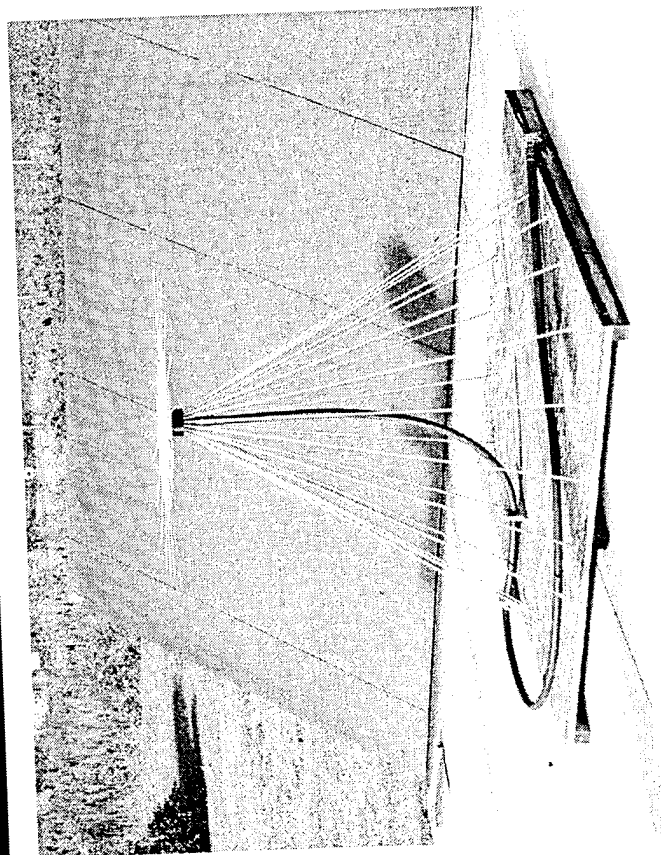
Freq Range	Modulation	Transmitter Power	Antenna Type	Antenna Polarization
10 KHz - 4 MHz	AM, FM, Pulsed, AM/FM, Wobulated(swept audio)	>15 KW	Long Wire	Vertical
4 MHz - 30 MHz	AM, FM, Pulsed, AM/FM, Wobulated, SSB	>15 KW	37' Trussed Whip	Vertical
30 MHz - 100 MHz	AM, FM, Pulsed, phase, Wobulated(swept audio)	>10 KW	10' Discone	Vertical
50 MHz - 100 MHz	AM, FM, Pulsed, phase, Wobulated(swept audio)	>10 KW	12' Log Periodic	Horizontal
100 MHz - 200 MHz	AM, FM, Pulsed, phase, Wobulated(swept audio)	1000 W	6' Log Periodic	Horz or Vert
200 MHz - 1000 MHz	AM, FM, Pulsed, phase, Wobulated(swept audio)	1000 W	Custom Double Ridge Horn	Horz or Vert
1 GHz - 2 GHz	AM, FM, Pulsed, phase, Wobulated(swept audio)	1000 W	Custom Double Ridge Horn	Horz or Vert
2 GHz - 4 GHz	AM, FM, Pulsed, phase, Wobulated(swept audio)	1000 W	Custom Double Ridge Horn	Horz or Vert
4 GHz - 8 GHz	AM, FM, Pulsed, phase, Wobulated(swept audio)	1000 W	Custom Double Ridge Horn	Horz or Vert
8 GHz - 18 GHz	AM, FM, Pulsed, phase, Wobulated(swept audio)	800 W	Custom Double Ridge Horn	Horz or Vert

Naval Electromagnetic Radiation Facility

January 2, 1996

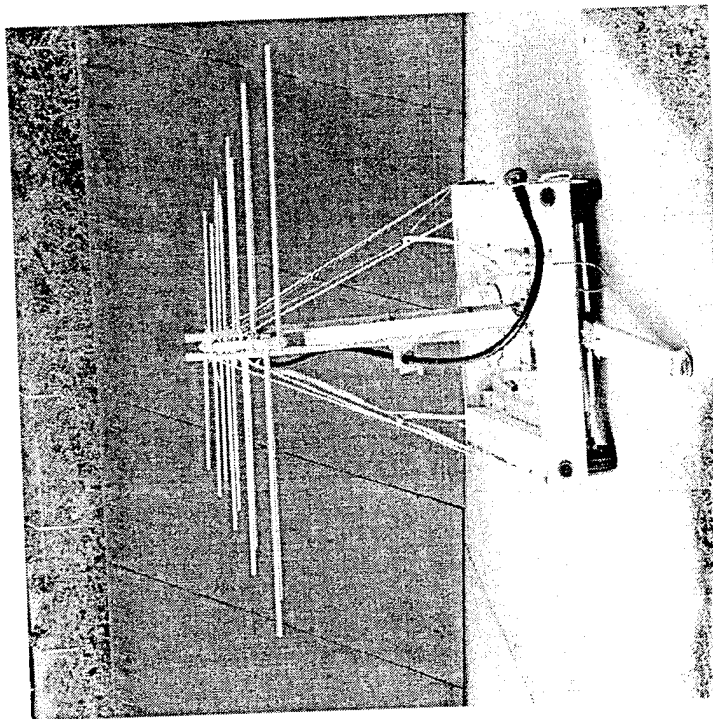


# Class A High Power Antennas



\* 30-100 MHz

\* 50-100 MHz

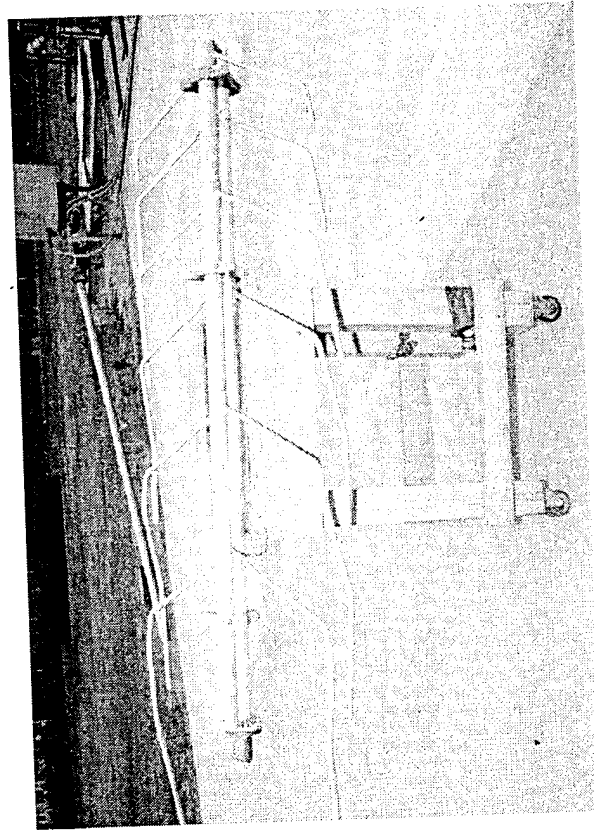


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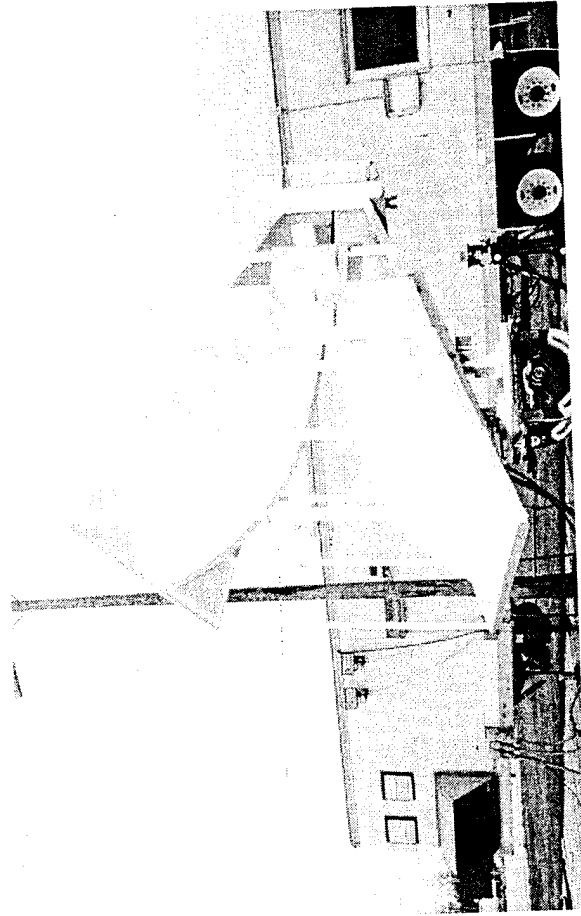


# *Class A High Power Antennas*



\* 100-200 MHz

\* 200-1000 MHz

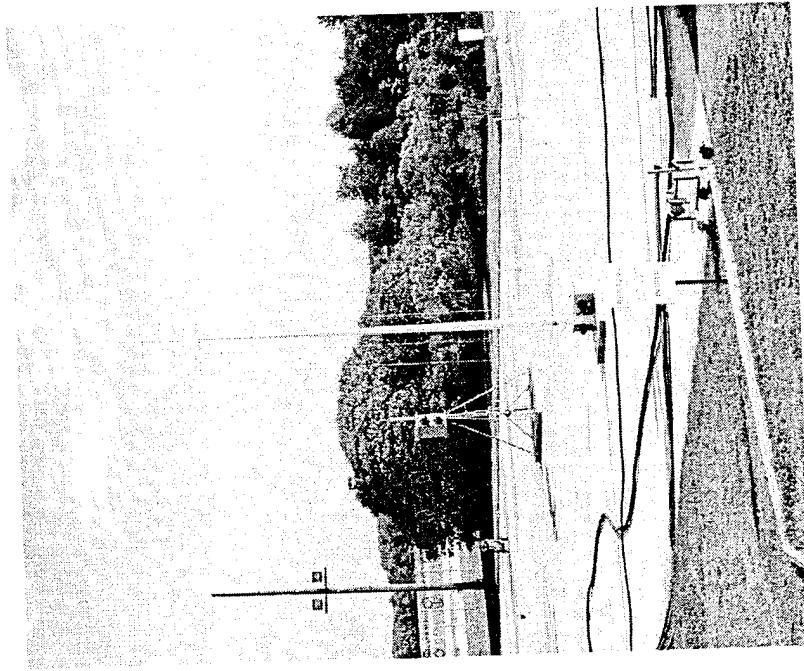


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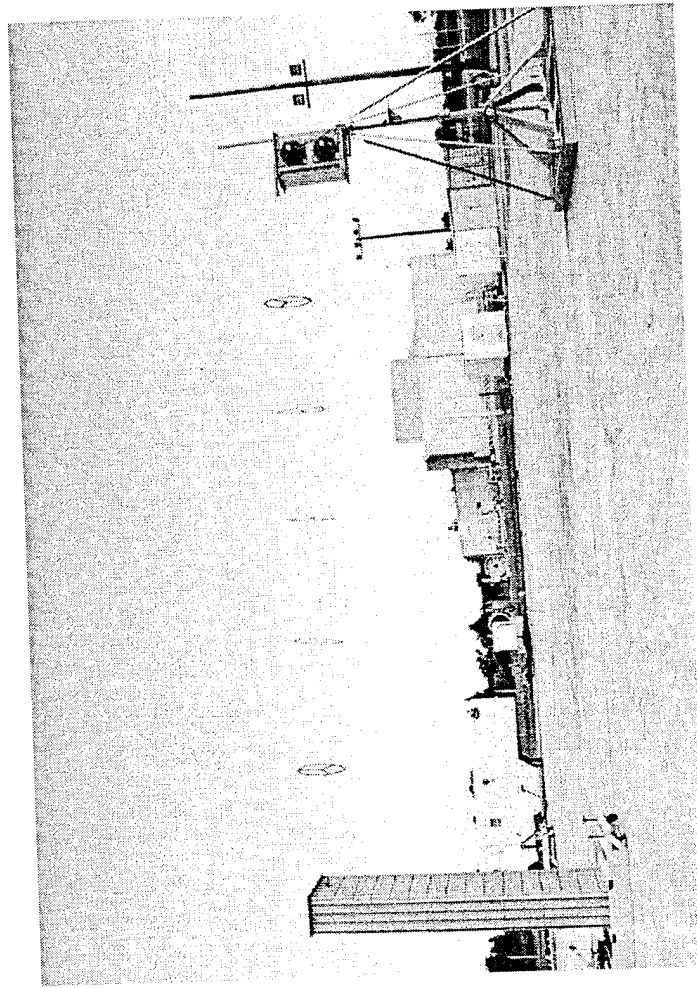
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# Class A High Power Antennas



\* 4-30 MHz



\*10 KHz-4 MHz

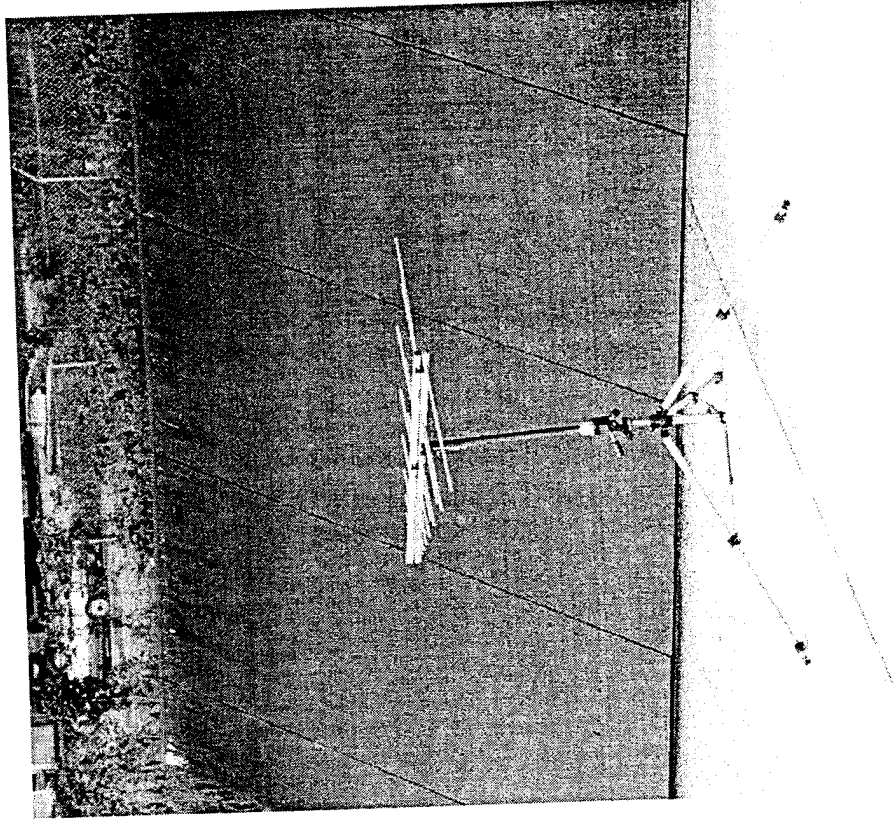
Naval Electromagnetic Radiation Facility

January 2, 1996



# Class A High Power Antennas

\* 100-1100 MHz



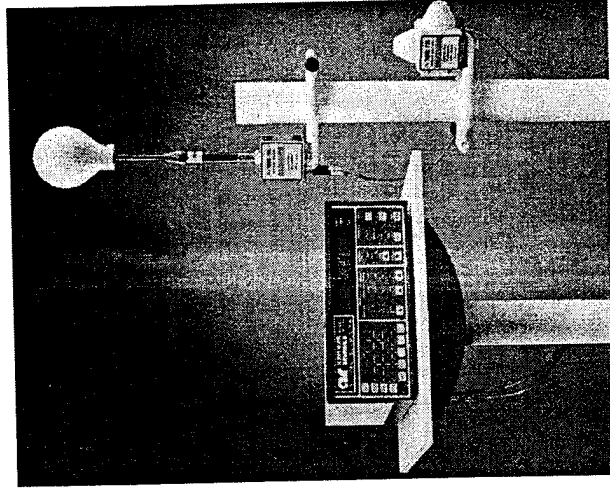
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# E-Field Calibration Equipment

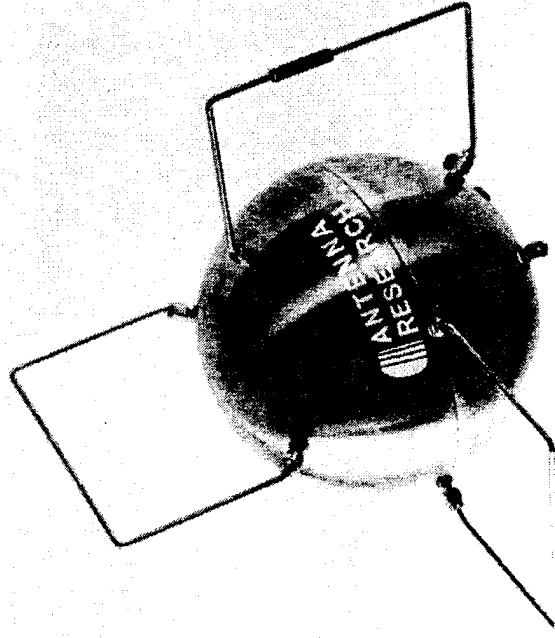
- ☐ 3 - Axis E-Field Probe
  - ☐ Amplifier Research FP2000 Probe/FM2000 Meter
    - 10KHz - 1 GHz
    - 4-300 V/M  $\pm$  1dB
    - Up to 8 Probes, 2 meters Available
- ☐ Amplifier Research FM 2000 meter, FP 2080 Probe
  - ☐ 80 MHZ-40 GHZ
  - ☐ 1-300 V/M
  - ☐ 4 Probes, 1 Meter Available





# *E-Field Calibration Equipment (Cont.)*

- ☐ E x H Field Probe
  - ☐ ARA IBS-30
  - ☐ Freq: 0.075-30 MHz
  - ☐ E-Field: 6-1500 V/M
  - ☐ H-Field: 0.04-6 A/M



- ☐ Features
  - ☐ Simultaneous E&H Field Measurements
  - ☐ Evaluation of Poynting Vector & Power Density
  - ☐ Evaluation of Wave Impedance



# *Typical Maximum E-Field Levels*

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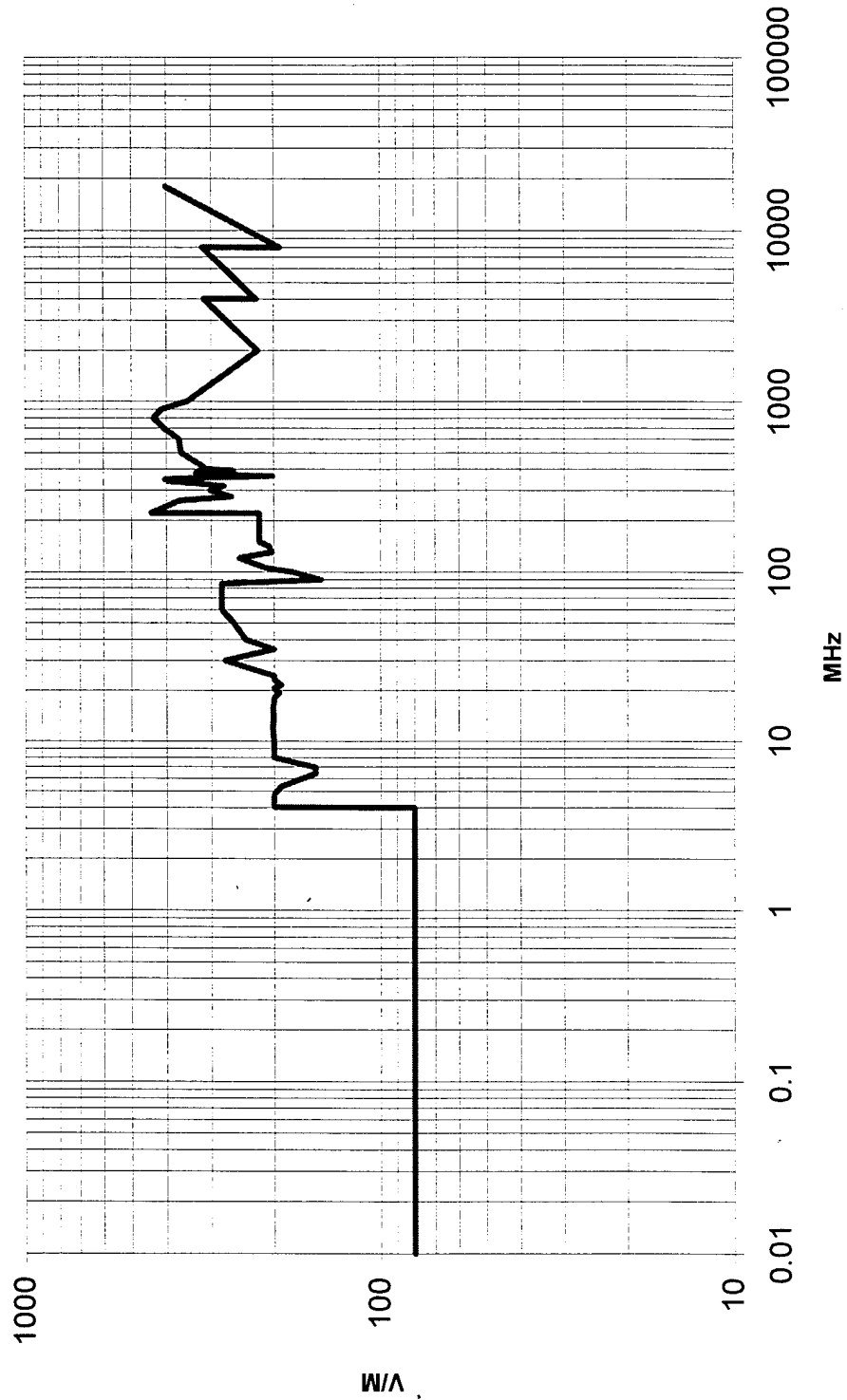
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- ☐ 10KHz - 18 GHz
- ☐ 10KHz - 4 MHz
- ☐ 4MHz - 30 MHz
- ☐ 30 MHz - 100 MHz
- ☐ 100 MHz - 1 GHz
- ☐ 1 GHz - 18 GHz



# 10KHz - 18 GHz

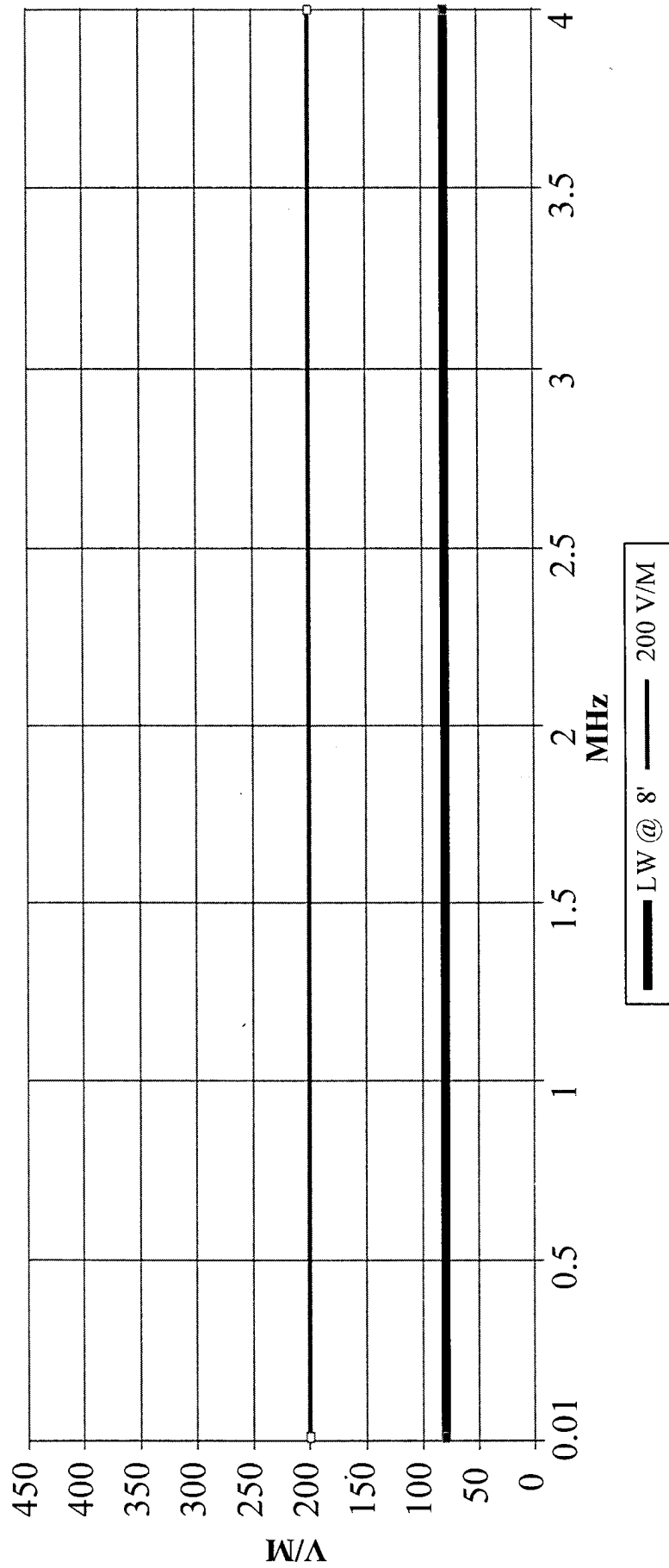
Max Possible E-Fields





# 10KHZ - 4 MHZ

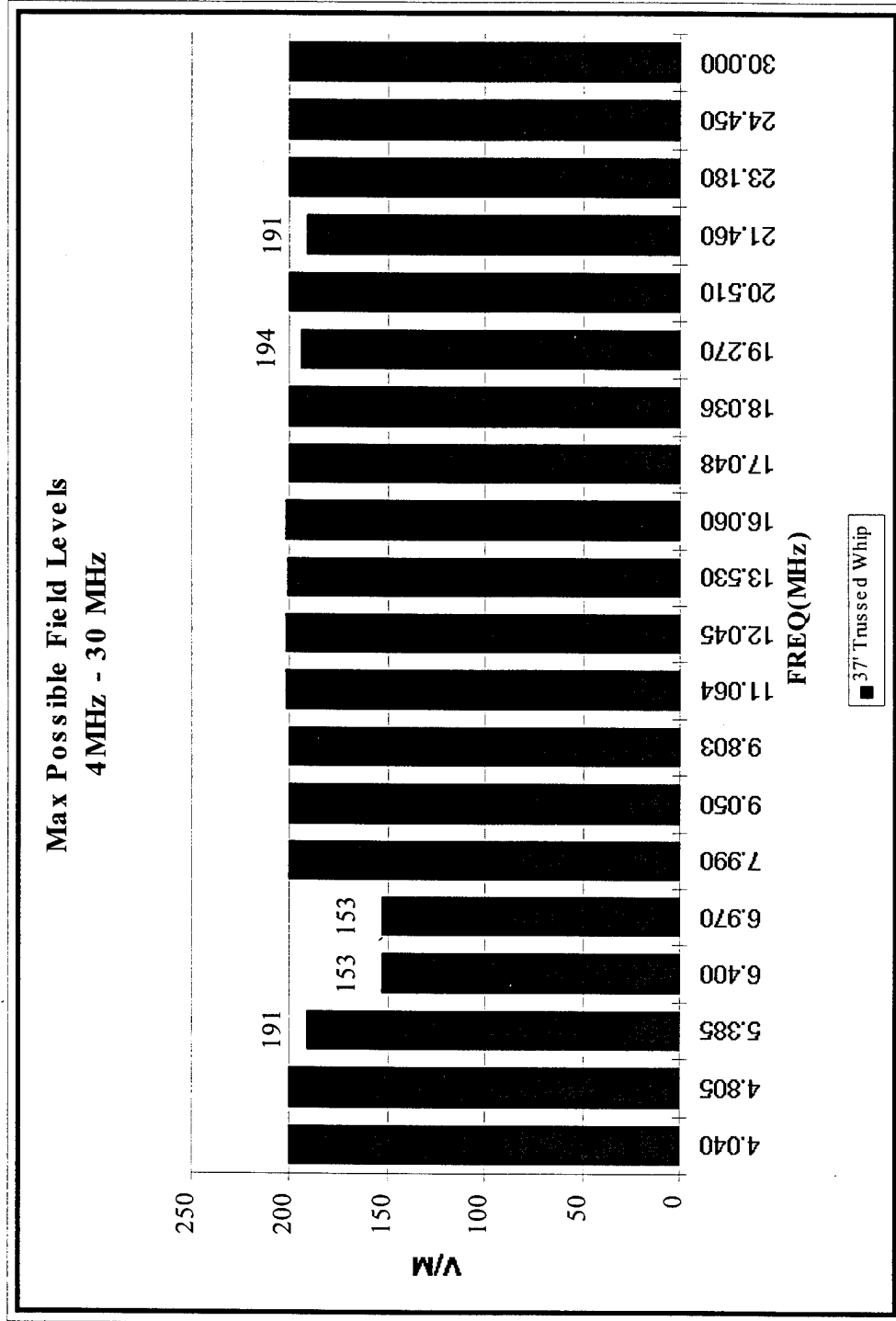
## Max Possible Field Levels





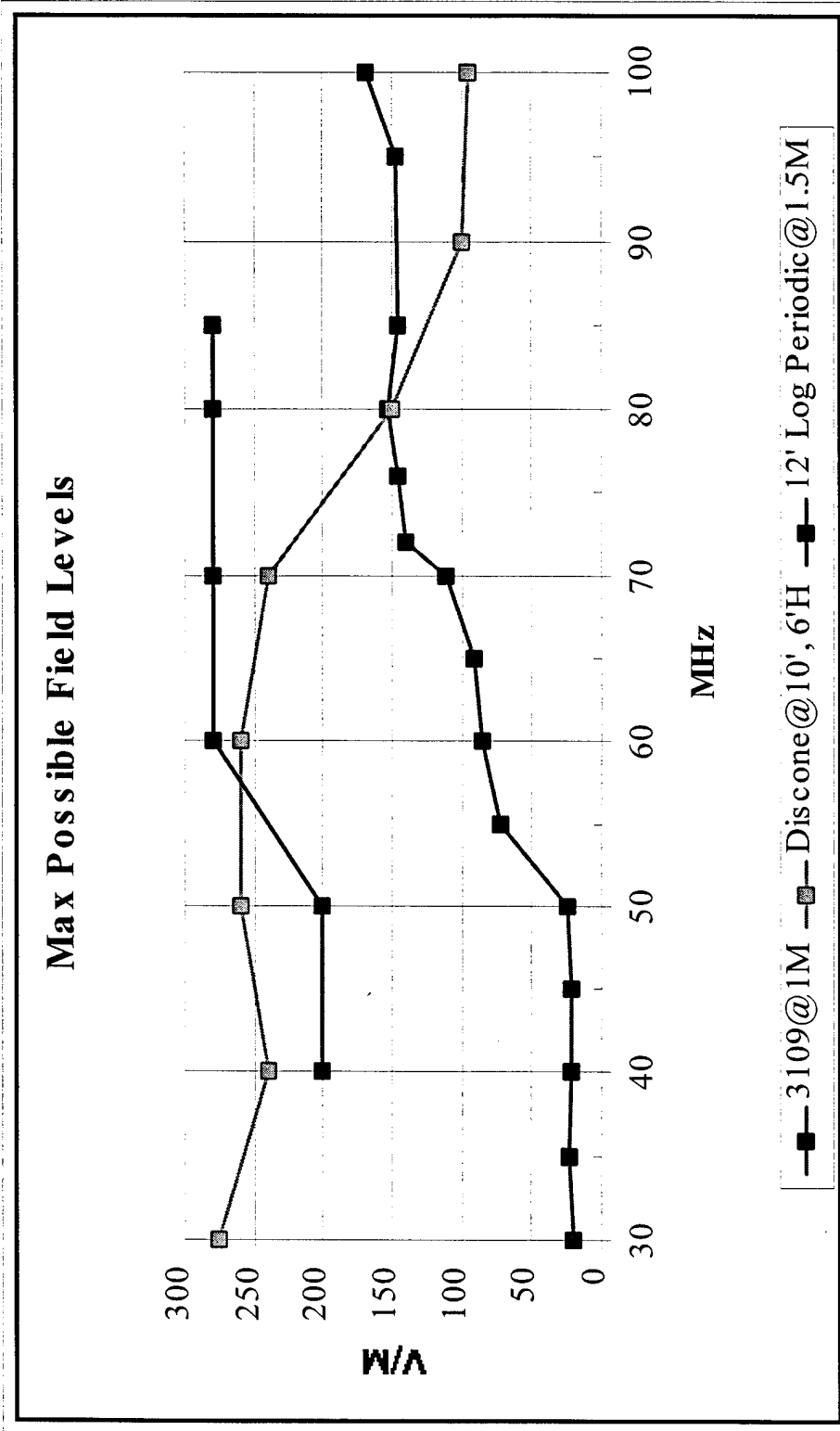
# 4MHz - 30 MHz

Max Possible Field Levels  
4MHz - 30 MHz





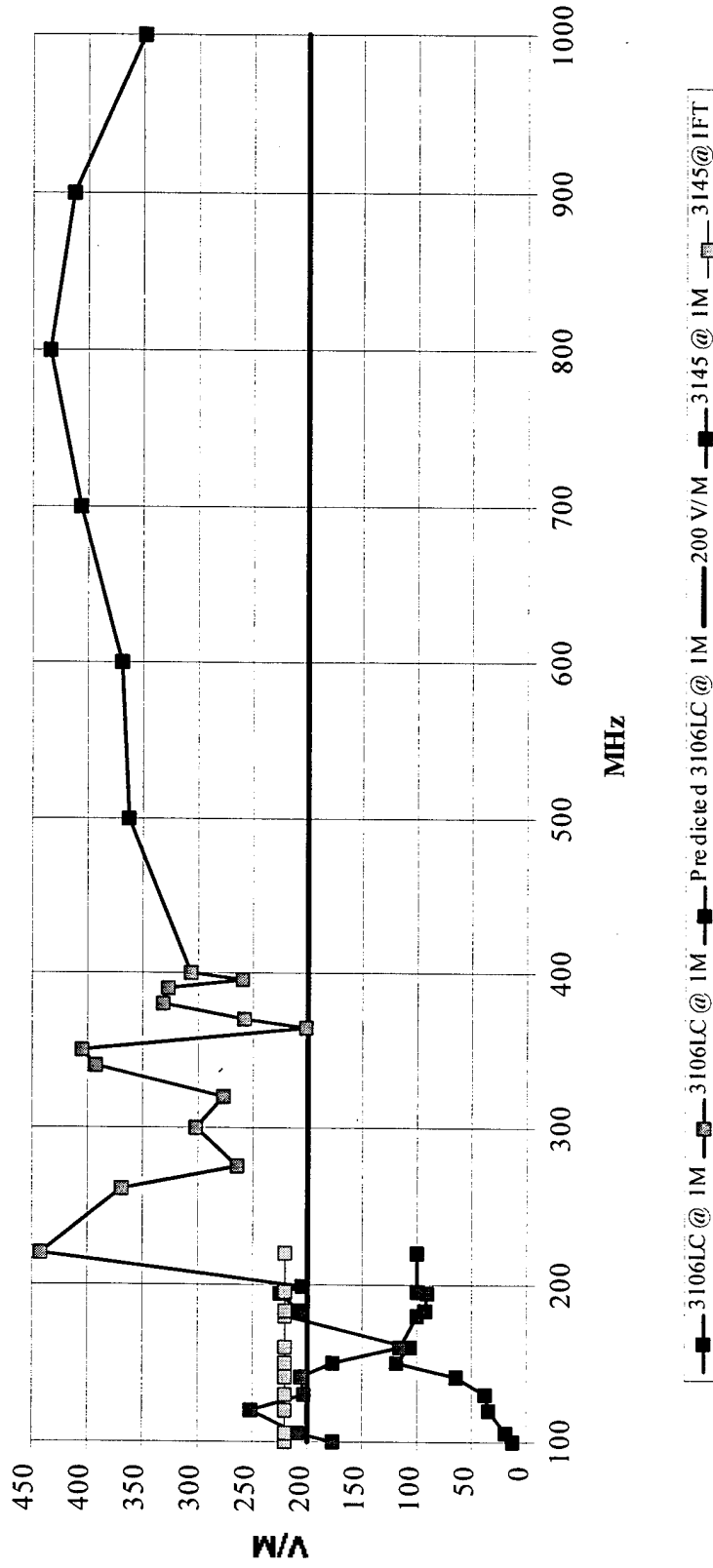
# 30 MHz - 100 MHz





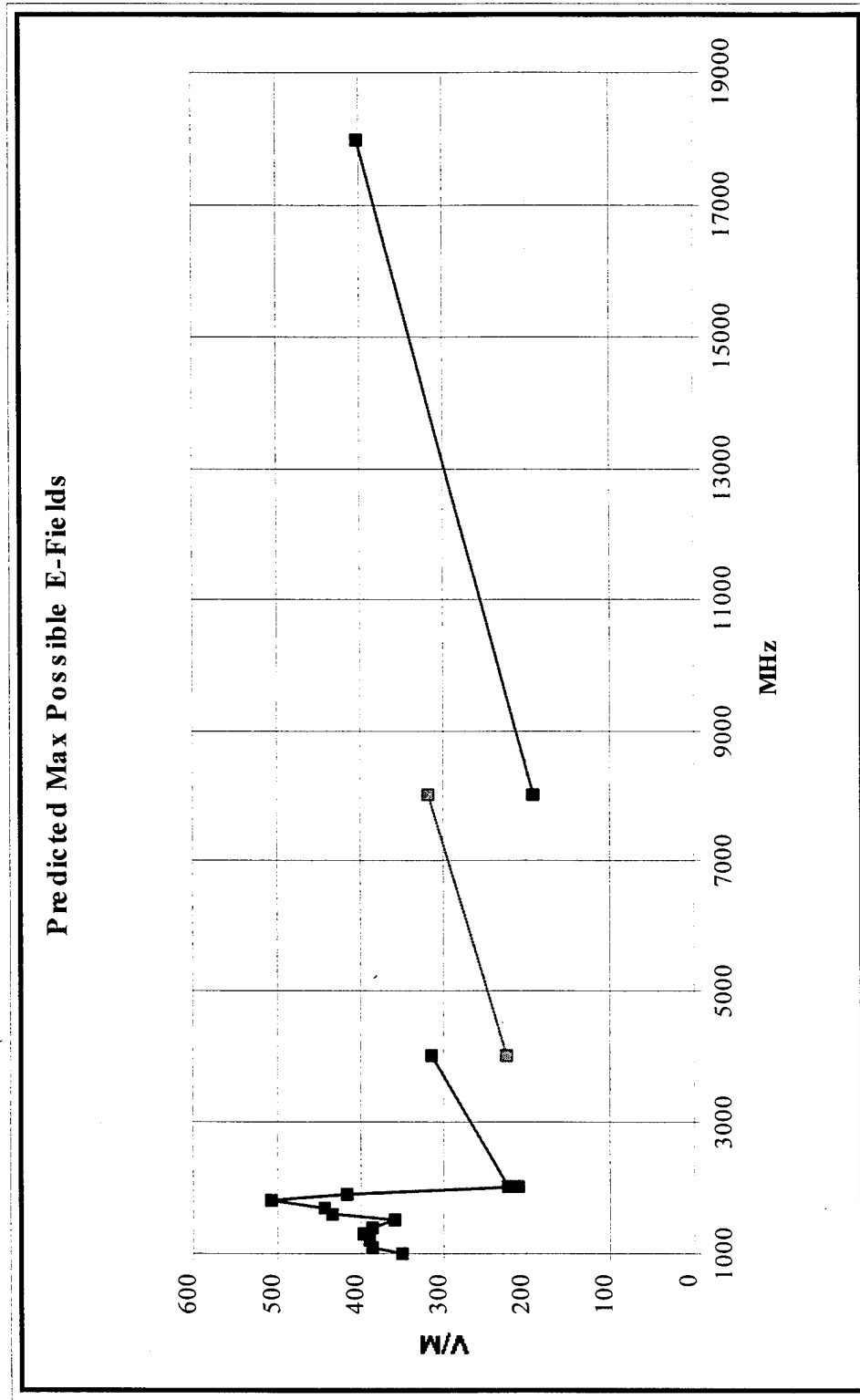
# 100 MHz - 1 GHz

Max Possible Field Levels





# 1 GHz - 18 GHz





# Naval Electromagnetic Radiation Facility

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